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ABSTRACT

An individuals ability to read is heavily influenced by the style in which he perceives letters and words. A study investigated the effect of the following two elements of perception: (1) field independence--the degree to which the subject is able to distinguish symbols and characters despite the complexity of the background; and (2) reflexivity--the degree to which the subject considers alternative interpretations. Using the Hidden Figures Test and the Matching Familiar Figures test, researchers examined 40 subjects between the ages of 15 and 17 who had been identified as either average or remedial readers. Test results showed that the average readers scored significantly higher, indicating that they were more field independent and reflective than the remedial group. A detailed discussion of the research methodology and tabular results are included. (EMH)

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A COMPARISON OF REMEDIAL AND NON-REMEDIAL READERS ON SELECTED PERCEPTUAL STYLE VARIABLES

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A great deal of research has been conducted in the field of remedial reading. Little has been done, however, to identify differences which may exist between remedial and non-remedial readers on the various dimensions of a group of individual-difference variables collectively refered to as cognitive style.

One approach taken in research to the amelioration of reading disabilities has been to first determine what special abilities or characteristics may underlie successful reading behavior. This study is representative of such an approach. It is an investigation of the differences between remedial and non-remedial readers at the high school level on the two perceptual, or cognitive, style variables of field independence/field dependence and reflectivity/impulsivity. The study is based on the rationale that since reading is, at least in part, a perceptual skill, variations in visual cognitive style may be related to variations in reading ability and success.

Reading requires several basic perceptual skills. Among these are the following:

1. ability to perceive and systematically analyze differences among visual symbols in the form of words and letters
2. ability to separate and recognize individual words and letters from a visual field

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Research in the field of visual perception has revealed two perceptual or cognitive style variables which may be related to these skills. These two variables are field independence/field dependence and reflectivity/impulsivity.

Both field independence/field dependence and reflectivity/impulsivity are dimensions of an area of visual perception which is generally refered to as cognitive style. The concept of cognitive style refers to psychological dimensions which "represent consistencies in an individual's manner or form of cognition" (Nelson, 1973); that is, to ways of acquiring and processing information. Messick (1966) states that cognitive styles "represent a person's typical modes of perceiving, remembering, thinking, and problem solving."

The field independence/field dependence dimension of cognitive style deals with the degree to which an individual is able to separate details from a stimulus field. Field independence implies an analytical, as opposed to a global, way of perceiving stimuli as discrete from their backgrounds, and demonstrates an ability to overcome an embedding context in a visual field.

Research on the influence of stimulus field on perception was begun by Gottschaldt, who hypothesized the existence of stable and consistent individual differences in perceptual performance. A continuation of this line of research by Witkin and others has led to the conclusion that field complexity factors influence some individuals far more than others, and to the establishment of two distinct styles of visual perception and cognition:

1. a perceptual style which is heavily influenced by field factors and the complexity of background
2. a perceptual style which is only slightly influenced by these factors

These perceptual styles are generally refered to as field dependence and field independence, respectively. A summary of the perceptual characteristics of these two types is provided by Witkin:

> The person with a more field-independent way of perceiving tends to experience his surroundings analytically, with objects experienced as discrete from their backgrounds. The person with a more field-dependent way of perceiving tends to experience his surroundings in a relatively global fashion, passively conforming to the influence of the prevailing field of context (Witkin, et al., 1962, p. 35).

Since reading requires the ability to separate and recognize individual words and letters in a stimulus field containing a great many of these elements, a field independent perceptual style seems likely to be characteristic of students who have success in reading. It was therefore hypothesized that non-remedial readers possess a more field independent perceptual style, while remedial readers possess a more field dependent style.

A second dimension of cognitive style which appears intuitively to bear a relationship to success in reading is the dimension of reflectivity/impulsivity. This dimension, frequently refered to as perceptual tempo, is basically concerned with the speed with which hypotheses are selected and information is processed. Impulsive individuals tend to offer the first answer that occurs to them, even though it is frequently wrong, while reflective ones tend to consider all the various possibilities before deciding on a response. Kagan, who has worked extensively with this variable, provides the following summary of the concept of perceptual tempo:

> The reflection-impulsivity dimension describes the degree to which a child reflects upon the differential validity of alternative solution hypotheses in situations where many response possibilities are available simultaneously. In the problem situations the children with fast tempos impulsively report the first hypothesis that occurs to them, and this response is typically incorrect. The reflective child, on the other hand, delays a long time before reporting a solution hypothesis and is usually correct (Kagan, 1966, p. 119).

Success in reading, particularly in the early formative stages, requires the ability to perceive differences in visual stimuli in the form of letters and words and to analyze them systematically without recourse to the impulsive selection of a solution. It was therefore hypothesized that non-

remedial readers possess a more reflective perceptual tempo, while remedial readers possess a more impulsive tempo.

Procedures

The study was conducted at Richard King High School in Corpus Christi, Texas. Forty students between the ages of 15 and 17 were identified with the Reading for Understanding Placement Test (Thurstone, 1963) as being at or above their respective grade level in silent reading comprehension. This group was designated as the non-remedial group for this study. A second group of 40 students between the ages of 15 and 17 identified as below their respective grade level in silent reading comprehension were also selected. This group was designated as the remedial group for the study.

The 80 students in the remedial and non-remedial groups were administered two tests to assess the two cognitive style dimensions of field independence/field dependence and reflectivity/impulsivity.

Field independence/field dependence was measured with the Hidden Figures Test (HFT; French, Ekstrom, & Price, 1963). In this test, the subject (S) is presented with a group of five simple geometric figures and a series of complex figures. For each complex figure, S is to find the simple figure which is concealed within it. The score made on the test is determined by totalling the number of correct responses and subtracting from that total a fraction of the number of incorrect responses. Items for which no response is made are not counted as either correct or incorrect.

The instrument used to assess reflectivity/impulsivity was the adult form of Matching Familiar Figures (MFF; Kagan, 1969). In this test, drawings of familiar objects (dog, airplane, dress, etc.) are presented to S along with eight similar variants. S must select the one variant which is identical to

the standard. The test consists of 12 separate items. On each item, S may give as many responses as he wishes. For each S, a record is kept of response latency to first answer given and number of incorrect responses on each item. A mean response latency and an error total is then computed for each S.

After all 80 Ss were administered both HFT and MFF, they were classified as field independent, field dependent, or indefinite on one perceptual style dimension; and as reflective, impulsive, or indefinite on the other dimension. Ss scoring in the upper one-third of the total sample of 80 on HFT were classified as field independent (N = 27). Those scoring in the lower one-third of the sample were classified as field dependent (N = 26). Those Ss were classified as reflective who scored above median mean latency (Md = 44.17) and below median errors (Md = 5.5) on MFF (N = 24). Ss were classified as impulsive if they scored below median mean latency and above median errors on MFF (N = 26). Table 1 summarizes the classification procedures.

The data obtained from the two testing instruments was analyzed in three stages. In the first stage of data analysis, over-all differences in performance of the non-remedial and remedial groups were compared on the three dependent measures of score on HFT, errors on MFF, and mean latency on MFF. These comparisons were made with three separate one-way analyses of variance.

The second stage of data analysis was the use of chi-square tests to examine the differences between expected and observed frequencies of field independents, field dependents, reflectives, and impulsives in the non-remedial and remedial groups.

The final stage of data analysis was the performance of a step-wise discriminant function analysis to determine whether the three dependent measures could accurately predict, or discriminate, the two categories of remedial reader and non-remedial reader.

Table 1
Groups Identified by Testing Instruments

		n	Total N
PERCEPTUAL STYLE (Measured by HFT)	Field Independent (upper 1/3 of sample)	27	
	Field Dependent (lower 1/3 of sample)	26	80
	Indefinite (middle 1/3 of sample)	27	
PERCEPTUAL TEMPO (Measured by MFF)	Reflective (above median mean latency and below median errors)	24	
	Impulsive (below median mean latency and above median errors)	26	80
	Indefinite (above median mean latency and above median errors OR below median mean latency and below median errors)	30	

Results

Differences in the over-all performance of the remedial and non-remedial groups are readily observable in the descriptive data of the two groups on the three dependent measures. This descriptive data is summarized in Table 2.

Table 2
Descriptive Data for Dependent Variables

	HFT for Non-Remedial Group	HFT for Remedial Group	MFF Errors for Non-Remedial Group	MFF Errors for Remedial Group	MFF Latency for Non-Remedial Group	MFF Latency for Remedial Group
Mean	4.06	2.31	5.52	6.95	55.41	39.27
Standard Deviation	2.70	2.33	2.32	3.01	21.12	17.47

Three separate analyses of variance showed that the observed differences between the remedial and non-remedial groups on score on HFT ($F = 9.491$, $df = 1,79$, $p = .003$), errors on MFF ($F = 5.482$, $df = 1,79$, $p = .02$), and mean latency on MFF ($F = 13.534$, $df = 1,79$, $p = .001$) were all significant beyond the .05 level. Tables 3, 4, and 5 summarize the three ANOVA's.

Table 3
Analysis of Variance for Scores Made by Remedial and Non-Remedial Groups on HFT

SOURCE	SS	df	MS	F
Between groups	61.688	1	61.688	9.491*
Within groups	506.967	78	6.500	
TOTAL	568.656	79		

*p = .003

Table 4
Analysis of Variance for Errors Made by Remedial and Non-Remedial Groups on MFF

SOURCE	SS	df	MS	F
Between groups	40.612	1	40.612	5.482*
Within groups	577.875	78	7.409	
TOTAL	618.488	79		

*p = .021

Table 5
Analysis of Variance for Mean Latencies Made by Remedial and Non-Remedial Groups on MFF

SOURCE	SS	df	MS	F
Between groups	5206.563	1	5206.563	13.534*
Within groups	30007.813	78	384.715	
TOTAL	35214.375	79		

*p = .001

In the second stage of data analysis, four chi-square tests were used to compare the expected and observed frequencies of field independent, field dependent, reflective, and impulsive individuals in the non-remedial and remedial groups. If no relationship existed between reading level and these

four categories of perceptual style, it could be expected that 50% (n = 13.5) of the 27 field independents identified by the testing instruments, 50% (n = 13) of the 26 field dependents, 50% (n = 12) of the 24 reflectives, and 50% (n = 13) of the 26 impulsives would occur in the remedial group and that the other 50% of each category would occur in the non-remedial group. The actual observed frequencies were as follows:

1. field independents in non-remedial group: n = 17 (63% of the field independents)
2. field independents in remedial group: n = 10 (37%)
3. field dependents in non-remedial group: n = 8 (31%)
4. field dependents in remedial group: n = 18 (69%)
5. reflectives in non-remedial group: n = 15 (62.5%)
6. reflectives in remedial group: n = 9 (37.5%)
7. impulsives in non-remedial group: n = 6 (23%)
8. impulsives in remedial group: n = 20 (77%)

Chi-square tests showed that the expected and observed frequencies of field independents ($X^2 = 1.82$, df = 1, $.20 > p > .10$) and reflectives ($X^2 = 1.50$, df = 1, $.30 > p > .20$) in the remedial and non-remedial groups were not significantly different. However, the expected and observed frequencies of both field dependents ($X^2 = 3.846$, df = 1, $p = .05$) and impulsives ($X^2 = 7.54$, df = 1, $p < .01$) were significantly different.

As the final stage of data analysis, a step-wise discriminant analysis was performed to see if the three predictor variables of score on HFT, errors on MFF, and mean latency on MFF could predict, or discriminate, the two criterion categories of remedial reader and non-remedial reader.

Table 6 shows the correlation matrix on which the discriminant analysis was based.

Table 6
Correlation Matrix for Three Predictor Variables

	HFT	MFF errors	MFF latency
HFT	1.00		
MFF errors	-.24**	1.00	
MFF latency	.03	-.39*	1.00

*$p < .01$
**$p < .05$

The discriminant analysis showed that scores on HFT (F to enter = 9.4947, df = 1,78, $p < .005$), errors on MFF (F to enter = 5.4818, df = 1,78, $p < .025$), and latency on MFF (F to enter = 13.5333, df = 1,78, $p < .001$) were each significant predictors of remedial and non-remedial reading status when each was considered separately as a simple linear predictor variable.

At step one of the discriminant analysis, a single predictor variable was entered into the prediction system. The first variable entered into the three-variable prediction system by the discriminant analysis computer program used for this study (BMD, 1974) was mean latency on MFF. This indicates that this variable was the best single predictor of the two criterion categories of remedial reader and non-remedial reader. Mean latency on MFF used by itself was a significant discriminator of remedial and non-remedial readers (approximate F = 13.5333, df = 1,78, $p < .001$). Table 7 shows the classifications made by the prediction system at step one of the discriminant analysis, with only the single variable of mean latency on MFF entered.

Table 7
Number of Cases Classified into Groups at
Step 1 of Discriminant Analysis

GROUP	Non-Remedial	Remedial
Non-Remedial	25*	15
Remedial	11	29*

*This represents the accurate prediction of 54 cases out of 80, or 67.5% accuracy.

At step one, the two predictor variables not entered into the prediction system were score on HFT and errors on MFF. The "F to enter" values computed for these two variables at step one indicated that score on HFT (F to enter = 7.4489, df = 1,77, $p < .01$) would add a significant amount of accuracy to the prediction system, but that the errors on MFF (F to enter = 0.8385, df = 1,77, $p > .25$) would not. This was predictable from the correlation matrix for the three predictor variables (see Table 6). Since latency on MFF and score on HFT were not significantly correlated with each other (but both were related to reading ability), score on HFT could be expected to provide a significant amount of prediction power not provided by latency on MFF. However, since errors on MFF was significantly correlated with both latency on MFF ($r = -.39$, $p < .01$) and with score on HFT ($r = -.24$, $p < .05$), that variable could not be expected to make any significant contribution to the prediction system beyond that already made by the other two variables.

At step two of the discriminant analysis, a second variable was entered into the prediction system. This second variable entered was score on HFT. This variable made a significant contribution to the accuracy of the prediction system (F to remove = 7.4489, df = 1,77, $p < .01$). The two-variable

prediction system was significantly accurate (approximate F = 11.05058, df = 2,77, $p < .001$). Table 8 shows the classifications made by the prediction system at step two of the discriminant analysis, with the two variables of latency on MFF and score on HFT entered.

Table 8
Number of Cases Classified into Groups at
Step 2 of Discriminant Analysis

GROUP	Non-Remedial	Remedial
Non-Remedial	26*	14
Remedial	10	30*

*This represents the accurate prediction of 56 cases out of 80, or 70% accuracy

At step three of the discriminant analysis, the final variable of errors on MFF was entered into the prediction system. The three-variable prediction system was significant (approximate F = 7.29572, df = 3,76, $p < .001$), but this third variable contributed no significant predictive power (F to remove = 0.0568, df = 1,76, $p > .25$); that is, the three-variable prediction system was not significantly different from the previous two-variable system. This is readily observable by comparing Table 9, showing the classifications made by the three-variable system, with Table 8.

Table 9
Number of Cases Classified into Groups at
Step 3 of Discriminant Analysis

GROUP	Non-Remedial	Remedial
Non-Remedial	27*	13
Remedial	11	29*

*This represents the accurate prediction of 56 cases out of 80, or 70% accuracy.

Conclusions

The data from this study allowed the following conclusions to be made:

1. As groups, remedial and non-remedial readers performed differently on the Hidden Figures Test, a measure of field independence/field dependence. The non-remedial group made higher scores, showing a greater degree of field independence.

2. As groups, remedial and non-remedial readers performed differently on Matching Familiar Figures, a measure of reflectivity/impulsivity. The non-remedial group made fewer errors and took longer time, showing a greater degree of reflectivity.

3. The remedial reader group had a greater proportion of field dependent individuals and of impulsive individuals than the non-remedial group.

4. A three-variable prediction system using scores on HFT, mean latency on MFF, and errors on MFF as the predictor variables could discriminate between remedial and non-remedial readers with 70% accuracy. However, due to the significant correlations between errors on MFF and the other two predictor variables, this three-variable prediction system was not significantly

different from a two-variable system using only scores on HFT and mean latency on MFF as discriminators of remedial and non-remedial readers.

It is concluded that this study demonstrates a relationship between two perceptual style variables (field independence/field dependence and reflectivity/impulsivity) and achievement in reading among high school students. It is suggested that the study be replicated to determine whether the results were artifactual and whether they occur in subjects of various age groups. It is also suggested that relationships between reading and other perceptual style dimensions (such as leveling/sharpening and field articulation) be investigated. If definite and consistent relationships between perceptual styles and level of success in reading can be established, it is possible that a prediction of potential failure in reading could be made at an early age through the use of perceptual style tests. Such prediction would allow the beginning of intensive help and remediation in reading and the perceptual skills which underlie it at an early age, thus perhaps preventing later failure in reading for many learners.

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